

Provisional Ecological Sites in MLRA 147 – Wetland Terraces and Shale Uplands

By Yuri Plowden, NRCS Ecological Site Specialist, 6-MIL Soil Survey Office, Mill Hall, PA (yuri.plowden@pa.usda.gov)

Introduction

Provisional ecological sites (PES) are being developed by the Natural Resources Conservation Service (NRCS) for soil survey mapunits within major land use area (MLRA) 147, Figure 1, the Northern Ridge and Valley Region of the Appalachians. PES are first approximations of conceptual groupings of soil map unit components and vegetation characteristics based on the similarities in response to management (USDA, 2015). Field work has begun to verify and refine two of the PES groupings, one for shale uplands and a second for poorly drained alluvial terraces. PES will eventually be developed into completed ecological site descriptions that will include fully described State and Transition Models (STM), interpretations for various uses including wildlife and forestry, plant inventory data, and information for use in conservation planning.

Figure 1. MLRA 147 extent map

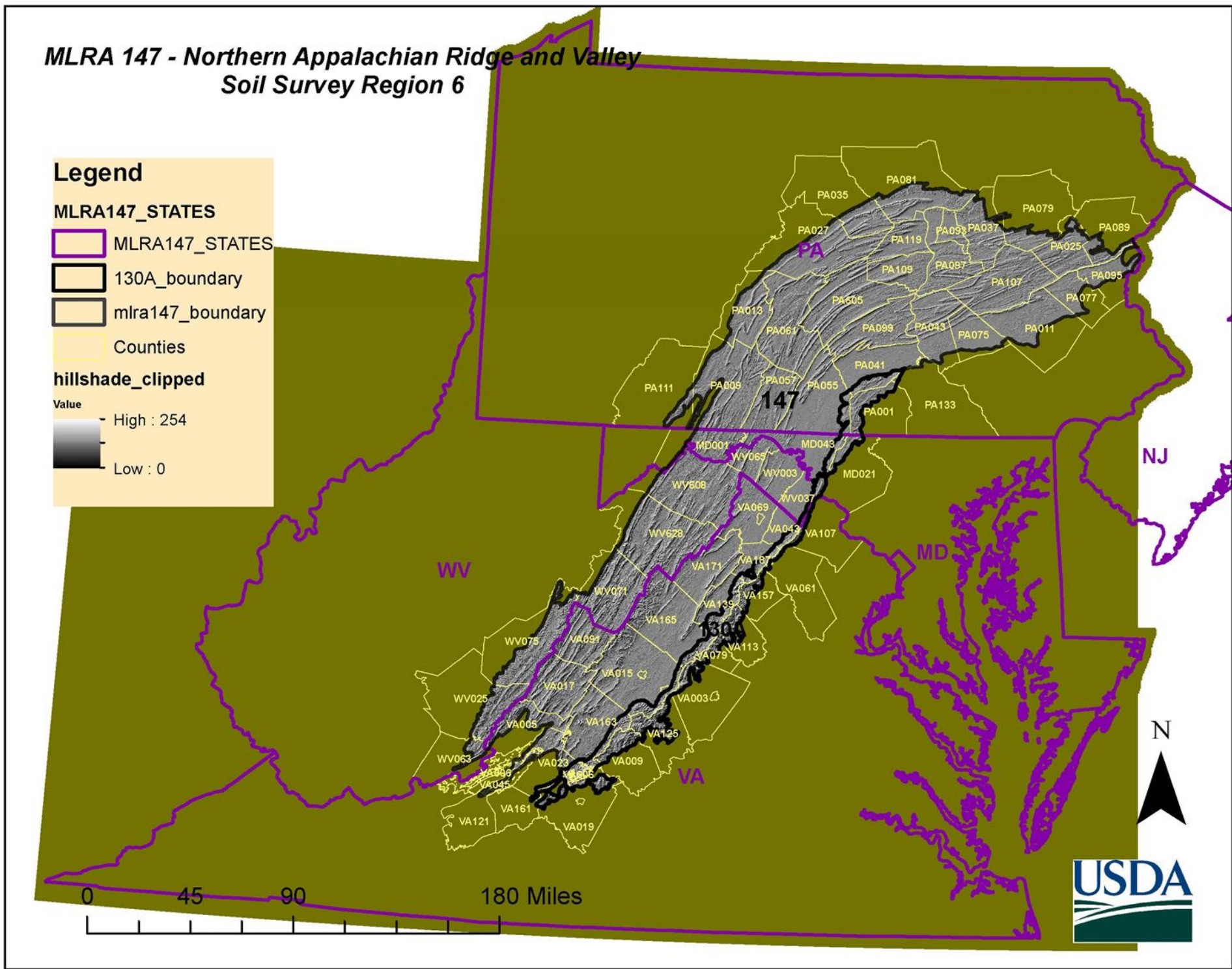


Figure 2. Average Annual Precipitation and Avg. Annual Temperature

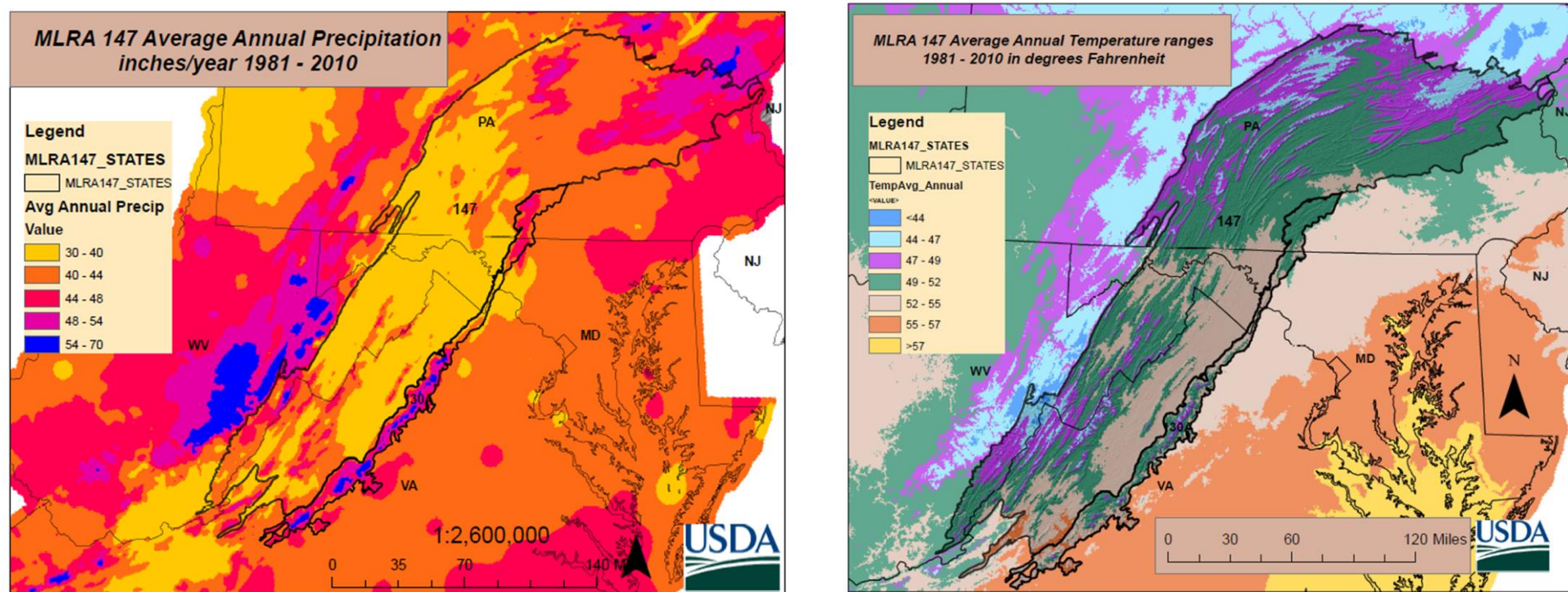


Figure 3. Extent Map for the Shallow to Moderately Deep Shale Upland PES

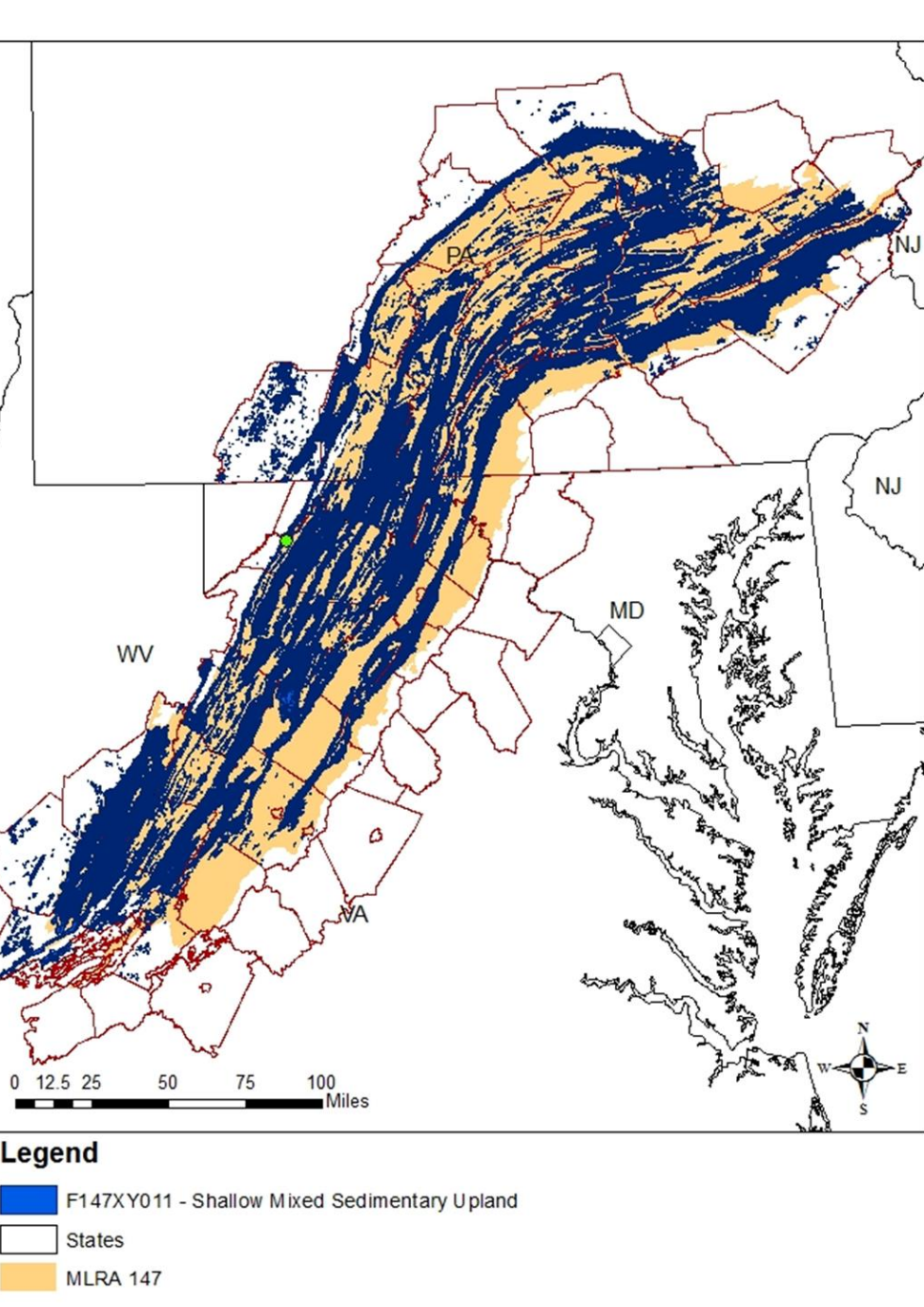
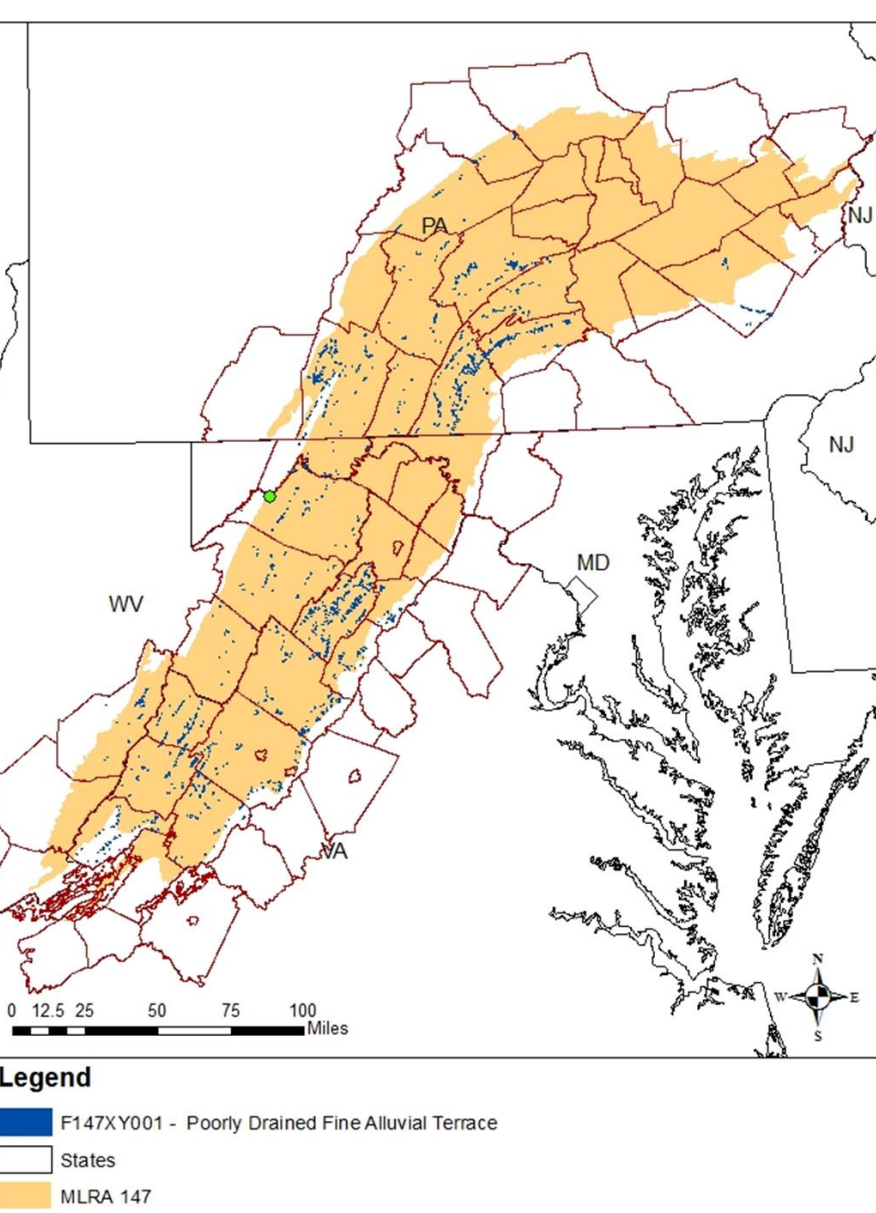


Figure 4. Extent Map for the Poorly Drained Fine Alluvial Terrace



Method

Soil survey data (SSURGO, 2015) was sorted into potential ecological sites by combinations of geomorphology, geology, and differentiating soil characteristics including particle size, depth to bedrock, and drainage. PRISM (PRISM 2013) data of mean annual air temperature and mean annual precipitation showed an area of the Great Valley of Virginia that is slightly warmer and drier than the rest of the MLRA, Figure 2. For now, this has not been used as a criteria for PES differentiation, but will be used to inform field work. The soil sort resulted in 20 PES, Table 1, to which each soil mapunit was assigned. In ArcMapv10.1, this soils GIS layer was intersected with Landfire's Biophysical Settings data layers (Landfire, 2015) and with plant site-specific inventories from the Heritage Programs of Pennsylvania (Zimmerman et al., 2012), West Virginia, (Zimmerman et al. 2012), Maryland (Harrison 2004), West Virginia (WVDNR 2014), and Virginia (Fleming et al. 2013) to determine broad reference vegetation classification. Combined with descriptions of communities from the Heritage programs and from NatureServe (NatureServe, 2015) these data were used to assign the most commonly associated plant communities to each PES.

The Shallow to Moderately Deep Upland Shale ecological site, Figure 3, and the Poorly Drained Fine Alluvial Terrace, Figure 4, PES were chosen for field evaluation. The former includes Berks and Weikert soil series which cover more than 3.2 million acres of the MLRA and the latter includes the hydric soil Purdy. PES information in wetlands is useful for NRCS wetland determinations.

Field sites were chosen from public and private lands to capture a range of geology, aspect, and landscape position. The high level of disturbance primarily through logging and farming throughout the eastern U.S. makes it extremely difficult to find areas of mature forest that can be considered reference states. Forest stands that seemed the healthiest as judged by lower level of invasive species, presence of saplings and seedlings of native tree species, and higher number of native species at the herbaceous and shrub layers, occurred in areas that had been logged but never farmed. For practical purposes, these were considered the reference states. The soil was described and NatureServe plant community types were recorded for each site. Basic State and Transition Models were developed, Figures 5 and 6.

Table 1 - Draft Provisional Ecological Sites (PES) for MLRA 147 – Appalachian Ridge and Valley

PES**	Ecological Site Name	Vegetative System	Reference Community - Phase
11	Shallow to Moderately Deep Mixed Sedimentary Upland Forest and Woodland	Central Appalachian Dry Oak-Pine Forest CES202.591	Acidic Oak-Hickory forests- CEGL008515 and Central Appalachian Pine - Oak Woodland- CEGL008389 Pine Oak Forest- CEGL008539
2	Deep Mixed Sedimentary Upland Forest	Northeastern Interior Dry-Mesic Oak Forest CES202.592	Central Appalachian Dry-Mesic Chestnut Oak - Northern Red Oak Forest- CEGL008057
3	Shallow to Moderately Deep Mixed Limestone Upland Forest and Woodland	Northeastern Interior Dry-Mesic Oak Forest CES202.592 Central Appalachian Alkaline Glade and Woodland CES202.602	Limestone Chinquapin Oak Woodland- CEGL006231
4	Mixed Limestone Upland Forest	Northeastern Interior Dry-Mesic Oak Forest CES202.592	Ridge and Valley Limestone Oak-Hickory Forest- CEGL004793 or CEGL006017 - Sugar Maple-Chinquapin Oak Forest
5	Sandstone Upland Forest and Woodland	Central Appalachian / Northern Piedmont Chestnut Oak Forest CES202.591 Central Appalachian Pine - Oak / Heath Woodland- CEGL004956 Lower New England High Slope Chestnut Oak Forest- CEGL006282 on shallowest inclinations.	Central Appalachian / Northern Piedmont Chestnut Oak Forest- CEGL006299 Central Appalachian Pine - Oak / Heath Woodland- CEGL004956 Lower New England High Slope Chestnut Oak Forest- CEGL006282 on shallowest inclinations.
7	Mixed Sedimentary Lower Slope Forests	Northeastern Interior Dry-Mesic Oak Forest CES202.592	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)- CEGL006304 ; CEGL007879 - Black walnut/Common Wingstem Forest for disturbed state
8	Poorly Drained Mixed Sedimentary Tootsloe Forest	Northeastern Interior Dry-Mesic Oak Forest CES202.592 North-Central Interior and Appalachian Rich Swamp CES202.605	Central Appalachian Forested Acidic Seep- CEGL006132 (keep) WV000553 (system 593 and 604) Put this where Andover is mapped on ridge tops.
9	Moderately Well Drained Mixed Limestone Footslope and Bench Forest	Northeastern Interior Dry-Mesic Oak Forest CES202.592	Ridge and Valley Limestone Oak-Hickory Forest- CEGL008517
10	Loamy to Coarse Terrace Forests	Northeastern Interior Dry-Mesic Oak Forest CES202.592 Southern and Central Appalachian Cove Forest CES202.573 Central Appalachian River Floodplain CES202.608	CEGL006237 - Sugar Maple-White Ash-America Basswood-Tuliptree/Blackhackberry Forest; CEGL007879 - Black walnut/Common Wingstem Forest for disturbed state Piedmont / Central Appalachian Silver Maple Forest- CEGL006217 CEGL004073 in richer substrates; CEGL007879 - Black walnut/Common Wingstem Forest for disturbed state
1	Poorly Drained Fine Alluvial Terrace Forest	Central Appalachian River Floodplain CES202.608	Northern Piedmont / Central Appalachian Pin Oak Floodplain Swamp- CEGL006497 add CEGL006248
12	Loamy Mixed Floodplain Forest	Central Appalachian River Floodplain CES202.608	Piedmont / Central Appalachian Silver Maple Forest- CEGL006217 CEGL004073 in richer substrates; CEGL007879 - Black walnut/Common Wingstem Forest for disturbed state
13	Coarse Mixed Floodplain Forest	Central Appalachian River Floodplain CES202.608	CEGL006184 - River Birch-American Sycamore/Jewweed Forest CEGL003896 - American Sycamore-River Birch Woodland for scour areas where ice scours the floodplain
14	Fine Wet Mixed Floodplain Forest	Central Appalachian River Floodplain CES202.608	Northern Piedmont / Central Appalachian Pin Oak Floodplain Swamp- CEGL006497 CEGL006497 - Acer rubrum-Fraxinus pennsylvanica-Ulmus americana/Boehmeria cylindrica Forest
15	Loamy to Coarse Mixed Limestone Floodplain Forest	Central Appalachian River Floodplain CES202.608	Piedmont / Central Appalachian Rich Floodplain Forest- CEGL004073 good (more noticeable in MD-WV & VA) CEGL007334 - Sycamore-Silver Maple Calcareous Floodplain forest (for small streams); CEGL007879 - Black walnut/Common Wingstem Forest for disturbed state
16	Somewhat Poorly Drained Loamy Mixed Limestone Floodplain Forest	Central Appalachian River Floodplain CES202.609	CEGL008575 - Green Ash-Mixed Hardwood Floodplain Forest (use as placeholder-works in PA, not listed further south for now) CEGL007879 - Black walnut/Common Wingstem Forest for disturbed areas
17	Wet Marl Lacustrine Terrace Forest	Laurentian-Acadian Wet Meadow-Shrub Swamp CES201.582	need data, but probably keep this separate. Called Marl Fens CEGL006170 -Baltic Rush Marl Fen
18	Mine Spoil Shrub Land	Northeastern Modified Successional Forest	CEGL005595 -Black Cherry-Tuliptree-Red Maple-Robinia pseudoacacia Ruderal Forest CEGL007279 Successional Black Locust Forest CEGL005595 - Quercus rubra-(Quercus alba)/Ilex montana/Dennstaedtia punctilobula-Lysimachia quadriflora Forest
19	Frigid Mixed Sedimentary Upland Forest		

**PES numbers are not all consecutive as some original PES were combined. These may be renumbered - or left blank to allow for splitting later.
Draft Reference Community data was gleaned from expert knowledge, 2015 field work, Heritage data from PA (Zimmerman et al. 2013), MD (Harrison 2004), WV (WVDNR 2014, WV subset 2002), and VA (Fleming et al. 2013); NatureServe (NatureServe 2015), and Landfire Biophysical Setting GIS layer (Landfire 2013).
PES sites were configured from analysis of soils data and local knowledge. These Provisional units are quite broad. Subsequent ESD work will most likely refine and split some of these concepts.

Ecological Summary of the Shallow Mixed Sedimentary Upland

The soil series associated with the Shallow Mixed Sedimentary Upland Ecological Site are: Weikert, Sequoia, Rough, Ramsey, Montevallo, Lehew, Klimesville, Gilpin, Gainesboro, Calvin, and Berks, photo 1. These soils have weathered from mixed geologies of acidic shales, sandstones, and siltstones and are mapped extensively throughout the Appalachian Highlands on several different geologic formations and on all slope aspects. The topography includes rolling hills to steep slopes. Depth to bedrock ranges from 10 to 40 inches (25 to 100 cm). These sites tend to create dry conditions with moderate to low forest productivity. The reference forest is an oak and hickory dominated community and is part of the Central Appalachian Dry Oak-Pine Forest System (CES202.591 from NatureServe, 2015). Although this system includes a number of diverse plant communities, a White Oak (*Quercus alba*) - Chestnut Oak (*Quercus montana*) - Pignut Hickory (*Carya glabra*) community was consistently observed in mature forests, photo 2. In addition, these landscapes included patches of Eastern White Pine (*Pinus strobus*) - Chestnut Oak (*Quercus montana*) forest and a more open Virginia Pine (*Pinus Virginiana*) -Oak shale woodland. Soil descriptions and plant inventory were collected on 67 sites throughout MLRA 147.

Figure 5. Draft State and Transition Model for Shallow to Moderately Deep Shale Upland

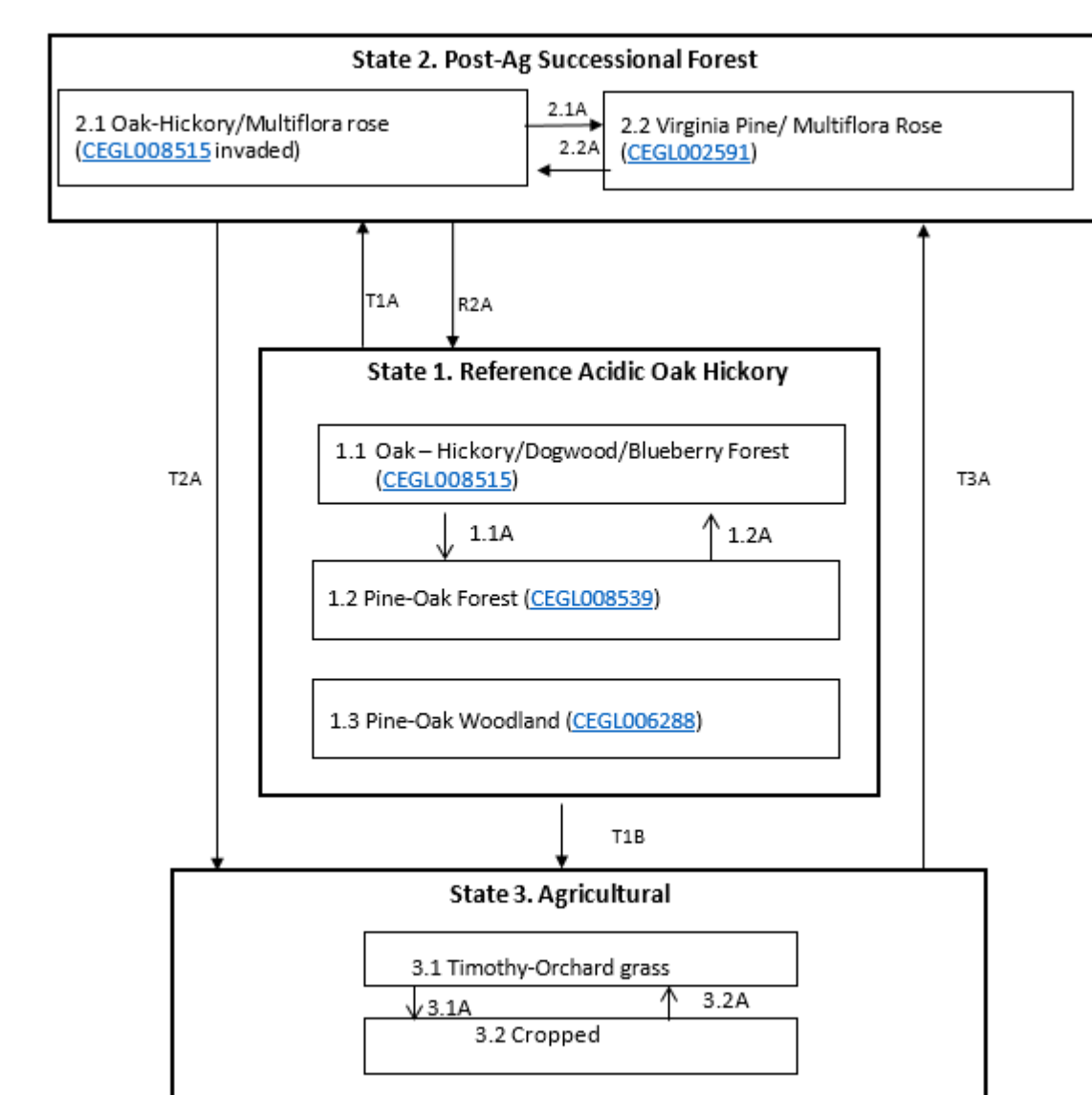


Photo 1. Representative Soil - Berks



Photo 2. Oak – Hickory Forest - Berks



Conclusion

Several useful methods exist to develop initial PES models using GIS analysis to classify the landscape and determine the most important predictive topographic, soil, and climate variables on vegetation (Ireland and Drohan, 2015; personal communications with 6-MOR soil survey staff, 2016). One advantage to developing PES using existing SSURGO data as described in this poster, is that the descriptions can then be easily linked to the National Soils Information System (NASIS) database and made available to the public through current soil survey data delivery methods like Web Soil Survey. Any initial model must eventually undergo field verification and will most likely be further split and refined to better capture the complexity of nature.

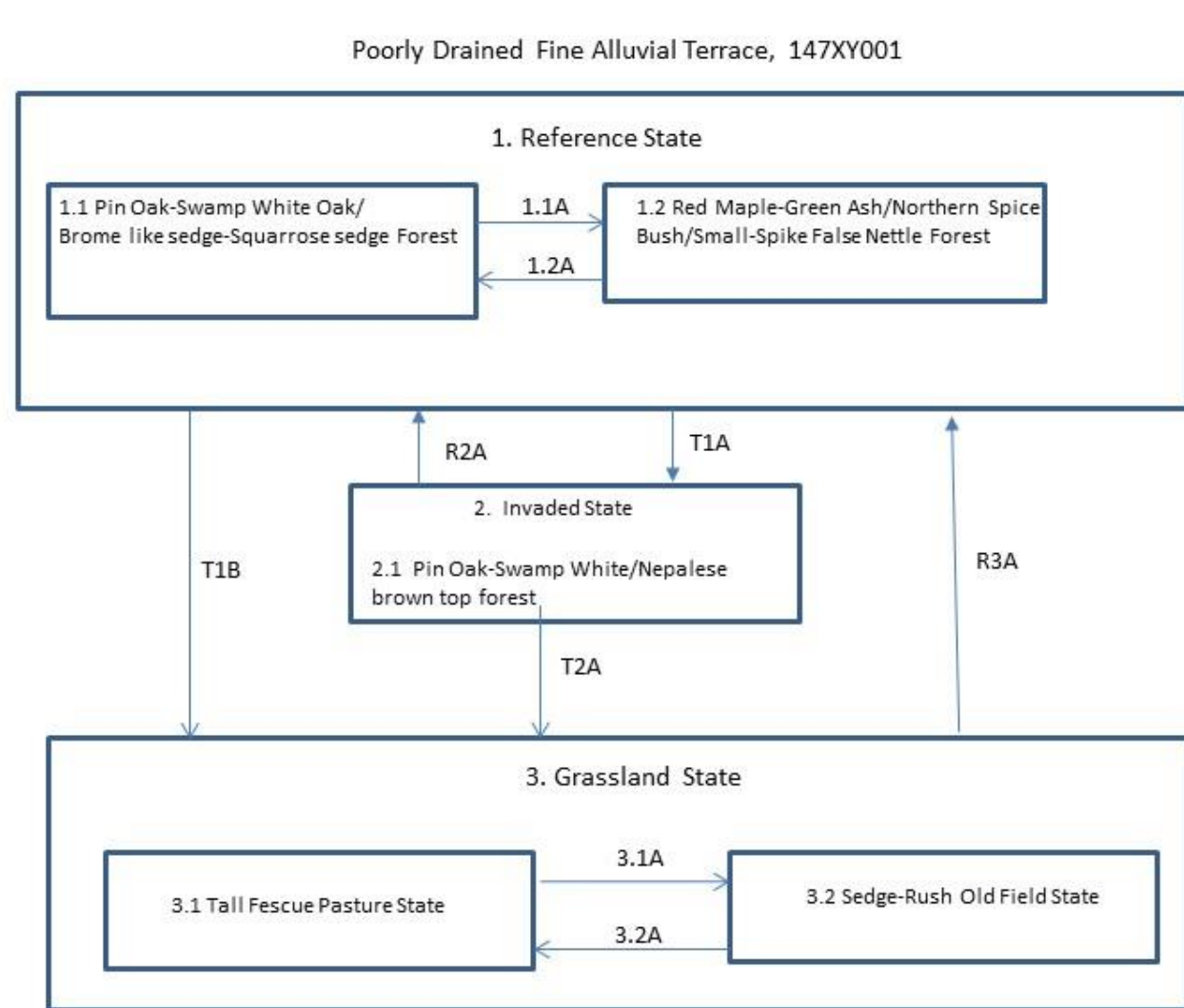
Acknowledgements

The Pennsylvania Natural Heritage Program, a division of the Pennsylvania Department of Conservation of Natural Resources has a 2 year agreement to assist with floristic inventory field data collection. Funding is through an agreement with NRCS in Pennsylvania. Field work was assisted by NRCS Resource and MLRA Soil Scientists in PA, WV, MD, and VA. Further botanical assistance was provided by WV Heritage Program and with data sharing agreements with PA, WV, VA, and MD Heritage Programs.

Ecological Summary of the Poorly Drained Fine Alluvial Terrace

The Poorly Drained Fine Alluvial Terrace ecological site includes very deep, poorly drained or very poorly drained soils with silty clay, silty clay loam, and clay loam textures, and occur on old alluvial terraces. The associated soil series are Purdy, Toms, Robertsville, Maurertown, and Lamington, photo 3. The seasonal high water table occurs within 0 to 12 inches (0 to 30cm) of the soil surface. The reference forest is part of the Central Appalachian River Floodplain CES202.608 (NatureServe, 2015). Two phases of the reference forest were consistently observed: an oak-mixed hardwood forest dominated by pin oak (*Quercus palustris*) and swamp white oak (*Quercus bicolor*) photo 4; and a maple-ash community dominated by red maple (*Acer rubrum*) – green ash (*Fraxinus pennsylvanicus*) and sometimes American elm (*Ulmus americanus*). Plant and soil descriptions were taken for 19 sites through MLRA 147. In addition, information from 16 plots in VA and WV Heritage data were also reviewed.

Figure 6. Draft State and Transition Model Poorly Drained Fine Alluvial Terrace



Code	Event/Process
1.1A	Natural succession, natural canopy openings, or possibly fire exclusion.
1.2A	Partial removal of over story canopy cover, and management of the understory to increase oak advancement.
3.1A	Abandonment of artificial drainage, natural succession, limited grazing.
3.2A	Drainage installation, and management for pasture
T1A	Invasion of Nepalese browntop
T1B, T2A	Clearing, draining, and managing for pasture
R2A	Control of Nepalese browntop and other invasive species
R3A	Abandonment of artificial drainage, planting of native species, management of weeds and undesired species

Photo 4. Pin Oak Forest



Photo 3. Representative Soil - Purdy



References

- Fleming, G.P., K.D. Patterson, K. Taverna, and P.P. Coulling. 2013. The natural communities of Virginia: classification of ecological community groups. Second approximation. Version 2.6. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.
- Harrison, J.W. 2004. Classification of vegetation communities of Maryland: First iteration. NatureServe and Maryland Natural Heritage Program, Wildlife and Heritage Service, Maryland Department of Natural Resources. Annapolis, MD.
- Ireland, A.W. and P. J. Drohan 2015. Rapid Delineation of Preliminary Ecological Sites Applied to Forested Northern Appalachian Landscapes. Soil Sci. Soc. Am. J. 79:185-192.
- LANDFIRE Existing Vegetation Type layer. (2013, June - last update). U.S. Department of Interior, Geological Survey. [Online]. Available: <http://landfire.cr.usgs.gov/viewer/> [2013, May 8].
- NatureServe 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://explorer.natureserve.org>. (Accessed: November-December 2015).
- PRISM Climate Group. Oregon State University, <http://prism.oregonstate.edu>, created February 26, 2013.
- Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database. Available online at <http://sdmdataaccess.nrcs.usda.gov/>. Accessed [04/09/2015].
- United States Department of Agriculture, Natural Resources Conservation Service. April 2015. Title 306 - National Instructions, Ecological Site Inventory and Ecological Site Description 430-306-NI.
- WVDNR [West Virginia Division of Natural Resources]. 2014. Photo2-WV database of community ecology plots. West Virginia Natural Heritage Program, WVDNR, Elkins, WV.
- Zimmerman, E., T. Davis, G. Podniesinski, M. Furedi, J. McPherson, S. Seymour, B. Eichelberger, N. Dewar, J. Wagner, and J. Fike (editors). 2012. Terrestrial and Palustrine Plant Communities of Pennsylvania, 2nd Edition. Pennsylvania Natural Heritage Program, Pennsylvania Department of Conservation and Natural Resources, Harrisburg, Pennsylvania.